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ABSTRACT

This paper describes case studies of 15 schools in one Canadian province that have been involved in a national project directed at the integration of information and communication technology (ICT) into teaching and learning. By focusing on a specific change related to the integration of ICT, the research explored two primary questions: (1) What factors facilitate or inhibit organizational learning? and (2) What are the sources of leadership that influence organizational learning and what is the nature of that leadership? Of the 15 schools studied, 6 were identified as innovative, 4 as moderately innovative, and 5 as static. Findings are described in detail for each of these three categories. The study provides empirical evidence to show that changing school practices, such as using ICT in teaching and learning, is very much dependent upon the level of organizational learning in a particular school. Findings also present evidence that formal planning processes provide continuity of organizational learning only if there exists a critical mass of leadership to facilitate the process. Contains 36 references. (AEF)

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Organizational Learning and the Integration of Information and Communication Technology in Teaching and Learning

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Introduction

This paper describes case studies of 15 schools in one Canadian province that have been involved in a national project directed at the integration of information and communication technology (ICT) into teaching and learning. Because the intent of the national project was to bring about significant changes to the teaching and learning process, these project schools provide an excellent venue for the study of the factors that facilitate or inhibit change.

The intractable nature of school practices is well documented (Deal, 1990; Deal & Peterson, 1999; Sarason, 1990, 1998; Sergiovanni, 1995). Sarason (1998) contends that we have spent billions and billions of dollars in efforts to bring about school change with little success. He argues that to teach children to read is "a piece of cake" compared with trying to change schools. Many researchers contend that if necessary changes are to actually happen, schools must become learning organizations–places where organizational learning is maximized (Darling-Hammond, 1996; Fullan, 1998; Leithwood, Jantzi, & Steinbach, 1999).

For the purposes of this study, organizational learning is defined as:

> the capacity (or processes) within an organization to maintain or improve performance based on experience. This activity involves knowledge acquisition (the development or creation of skills, insights, relationships), knowledge sharing (the dissemination to others of what has been acquired by some), and knowledge utilization (integration of the learning so that it is assimilated, broadly available, and can also be generated to new situations). (DiBella, Nevis, and Gould, 1996, p. 363)

This definition assumes that learning occurs naturally as the organization adapts over time. It also implies that such learning brings the organization closer to its goals. Consistent with this definition as well, DiBella, Nevis, and Gould (1996) contend that organizational learning occurs "by building on existing capabilities or developing new ones. The latter involves a change in culture, the former involves improving current capabilities. Organizations can enhance their learning capability through either approach" (p. 361). The researchers in this study focussed on organizational learning that occurred in the case study schools in the context of clear societal expectations that information and communication technology be integrated into the teaching and learning process.

For the past two decades, there has been a growing body of research on how organizations learn (Argyris and Schön,1978, 1996; Daft & Huber, 1987; Fiol and Lyles,1985). This body of research provides evidence that there are multiple processes and factors that either facilitate or impede organizational learning. Argyris and Schön (1978) contend that organizational learning is inhibited when managers define goals independent of others, manage the environment unilaterally, maximize winning, minimize generating or expressing negative feelings, and value rationality at the expense of feelings. As well, Hendry (1996) suggests that organizational culture can exert conformity and exercise control, thereby, inhibiting organizational learning. Senge (1990) suggests that learning is enhanced if organizations engage in the five disciplines of the learning organization: personal mastery, team learning, mental models, shared vision, and systems thinking. Contrarily, he contends that organizations that do not focus on the development of the five disciplines have

learning disabilities that inhibit learning. Louis (1994) summarizes conditions that facilitate organizational learning in schools as follows: decentralization, leadership that is closely identified as feminine, investment in research and development and dissemination of generated knowledge. the outside environment particularly other organizations, a crisis, and a strong connection between an action and the outcome. Through an analysis of three distinct, but related research projects. Leithwood, Leonard, and Sharratt (1997) found that organizational learning in schools was influenced by the district, school leadership, school culture, structure, and the community.

As is apparent in the above discussion, among the key variables related to organizational learning is leadership. In fact there exists considerable evidence that strong school leadership is essential to organizational learning in schools (Leithwood, Jantzi, & Steinbach, 1999; Sheppard & Brown, 2000). As well, there is a growing body of research suggesting that the leadership that will most likely maximize organizational learning in schools is leadership that moves away from technological, hierarchical, rational planning models, toward cultural, collaborative approaches in which teachers are viewed as partners (Darling-Hammond, Cobb, & Bullmaster, 1999; Fullan, 1999; Hargreaves & Evans, 1997; Leithwood, Jantzi, & Steinbach, 1999). For example, Mintzberg commented that society is "looking for leaders in the wrong places," that people look for great leaders who can "single-handedly keep enormous companies moving forward" (Mintzberg, cited in Smith, 1999, p.92). His point is that such leaders cannot do it alone. He contends that the role of chief executives has been overplayed. Education, influenced by leadership theories and expectations in the greater society, is no different. For example, Lambert, Collay, Dietz, Kent, & Richert (1996) comment on the existence of educational hierarchies:

> Since the days of the Egyptians and Romans, organizational ideas have tended toward amassing power and authority at the top of a hierarchy. The bureaucracy of schools creates conditions of social interaction that imitate factory hands in a production line .... Those at the top have the right to direct the behaviours of those further down in the hierarchy. Because those at the bottom (factory workers, teachers, students) are always larger in number than those at the top, strategies have to be used to establish and maintain control. These strategies have involved rules, regulations, punishments, incentives, and cultures based on formal authority, patriarchy, and isolation. These ideas have become particularly fixed and unchallenged in public bureaucracies such as education. (p. 3)

While understandings related to organizational learning have grown and there are growing numbers of researchers who support the claim that organizational learning offers promising directions for research, school improvement, and the implementation of reform initiatives (Cousins, 1996; Darling-Hammond, 1996; Fullan,1998; Leithwood & Aitken, 1995; Leithwood & Louis, 1998; Leithwood, Leonard,& Sharratt, 1997; Louis, 1994; Mitchell, Sackney & Walker, 1996; Prestine & Dole, 1995; Sheppard & Brown, 1996), the relevance of organizational learning to education requires empirical study (Leithwood and Louis, 1998). As well, there continues to exist an urgent need to develop our understandings of connections between leadership and organizational learning in educational organizations (Leithwood & Louis, 1998). This study builds on the current research

and attempts to contribute to our understanding of how organizational learning occurs in educational settings and how leadership is related to it. By focussing on a specific change related to the integration of ICT into teaching and learning in fifteen case study schools, the researchers attempted to explore two primary questions: (1) What factors facilitate or inhibit organizational learning? (2) What are the sources of leadership that influence organizational learning and what is the nature of that leadership?

Methodology

Site Selection

This study was conducted over an eight month period in 15 schools in one Canadian province that has been involved in a national project directed at the integration of ICT into teaching and learning. Because of the variety and complexity of factors believed to be related to organizational learning and the integration of ICT into teaching and learning, a case study approach was deemed to be the most appropriate.

A case study approach, implying a limited number of sites to be studied in detail, required that a careful consideration had to be given to site selection. Purposeful sampling was employed to insure the selection of information-rich sites that allowed the researcher to obtain detailed descriptions of each case to document uniqueness and to determine general patterns that are shared by heterogeneous cases.

The following factors were considered when choosing the case study schools:

- Language and culture - Anglophone / Francophone
- Levels of schooling - primary / elementary / secondary
- School size - small / large
- Community size - urban / rural
- The level of perceived involvement in the national project focussed on the integration of ICT into teaching and learning.

The selected case study schools included:

- At least one school in each of 11 school districts
- 14 Anglophone schools and 1 Francophone school
- 6 k-12 schools and 9 grade-specific schools
- 5 small, necessarily existing schools
- 8 rural and 7 urban schools

- 10 active schools and 5 static schools in respect to ICT integration into teaching and learning as determined by the research team on the basis of preliminary analysis of the schools' web sites and upon recommendation of the director of the provincial Student and Teacher Educational Multimedia Network (STEM~Net).[1]

Data Collection

One researcher spent three days in each of the schools. Data were gathered through field notes of observations and through semi-structured interviews with each principal, teachers, the technology teacher, the teacher-librarian, and students. Teachers were chosen according to the following criteria: a teacher known to be active in the integration of information technology in instruction; a teacher recommended by the principal; and a teacher chosen by the researcher at random from the faculty list. Three groups of students were chosen at each school to represent grade levels consistent with school type (primary, elementary, intermediate, and high school). At least one of these student groups had experience in the use of information technology in their learning. The other two student groups were chosen at random from class lists. In addition to the data gathering at each school, the researchers interviewed four members of STEM~Net. For the component of the research reported in this paper, data from interviews with students and members of the STEM~Net staff were used primarily in order to establish the level of innovation of each of the case study schools.

The researchers conducted 90 interviews: 15 principals, 46 teachers, 27 groups of students and 4 members of the STEM~Net staff including : the director, the senior training officer, the provincial coordinator for federally funded Internet-based resource units, and the Canadian coordinator of a national school Internet news program. All interviews were recorded and later transcribed.

A variety of methods were used to analyze the collected data: constant comparative method, theoretical memos, clustering of conceptual groupings and corresponding matrices (Glaser & Strauss, 1967; Miles & Huberman, 1994; Strauss & Corbin, 1994). Data from two schools were coded by two researchers to insure inter rater reliability of the coding. Following an intensive reflective session related to coding, all other data were coded by one researcher. Some codes were developed deductively on the basis of the current literature related to the organizational learning framework that guided the analysis. Other codes were developed inductively during the process of interviews on the basis of field notes, and yet other codes were added during the analysis as the researchers uncovered unexpected themes (Miles & Huberman, 1994; Potter, 1996).

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[1] STEM~Net is the primary Internet provider to all k-12 teachers in the province, and acts as the coordinator of the national projects related to the integration of ICT into teaching and learning.

Sources and Nature of School Leadership

Of the fifteen schools that were studied, the research team identified six of them as innovative, four as moderately innovative, and five as static. See Table 1. These classifications were made by a team of four researchers using one component of the national selection criteria set by SchoolNet[2] in their Network of Innovative Schools project. This one component, using six indicators, was designed to evaluate on a five point scale, the extent to which ICT was integrated across the curriculum and used to improve learning. The schools identified as innovative are labelled as follows: School Two, School Three, School Seven, School Eight, School Ten, and School Fifteen. These schools are recognized by their individual communities, their school districts, and STEM~Net personnel for their innovative use of ICT. Students at these schools accept ICT as a natural part of their learning environment.

INSERT TABLE ONE ABOUT HERE

The research team identified School One, School Five, School Six, and School Twelve as moderately successful in ICT innovation. In these schools, a "critical mass" of pioneer teachers is involved in the use of ICT to expand learning opportunities for their students. These pioneer teachers have integrated ICT across the curriculum with their own classes, but they are struggling with implementation issues in order to increase use throughout the school.

School Four, School Nine, School Eleven, School Thirteen, and School Fourteen were designated static schools in respect to the integration of ICT into teaching and learning. While teachers in these schools have had several opportunities to learn ICT skills, ICT implementation is primarily restricted to computer courses that are mandated as part of the required provincial curriculum. One or two teachers who have a special interest in ICT may have initiated several special projects. Otherwise, expertise in ICT is limited. There appears to be limited vision of the potential of ICT in the teaching and learning environment and therefore, there is practically no awareness of the need for change.

Leadership in Innovative Schools

Leadership in the selected innovative schools is collaborative, supportive of innovation and risk taking, and inclusive of others, including teachers, parents, and other community partners. While there is considerable dependence upon teacher pioneers, regular teachers are becoming increasingly comfortable with the use of ICT. Morale is generally high throughout each of these schools and team leadership is apparent. The teachers, students, and parents of those schools are excited about the extent of innovation in their school and are quite anxious to share their experiences with others.

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[2]SchoolNet is a collaborative initiative of the Government of Canada through Industry Canada, the Provincial / Territorial Ministries of Education and the private sector. Its goal is to facilitate access of Canada's schools and public libraries to the Internet.

Leadership at School Two appears to be shared among teachers, parents and students. The principal articulated that he believes in shared leadership and described how he includes parents, students, and teachers as decision-makers in the school improvement process. He stated:

> Well, shortly after I became principal, school development and school improvement were something that struck me right away in my principalship. Basically, it promoted shared leadership. . . . One thing that I did is that I included a delegation of students and parents, as well as teachers. So, when we made decisions it wasn't made by staff, it was made by a delegation of staff, students and parents. At a three-day conference we articulated our values, our belief statements, and our mission statement, and we set our direction. We also identified a number of priorities, and committees were set up to deal with them.

A teacher confirmed the school's involvement in school improvement. She reported that two of the priorities identified during a three-day school improvement conference were to focus on improved student achievement and on the development of ICT. Further, she noted the positive impact of the process on teachers' willingness to participate as teacher leaders.

> We've been going through a school improvement process for a number of years. We started this school improvement process about five or six years ago and we've gone through the growing pains of it. But we're at a point now that teachers feel free. If they see something that needs to be done, they just feel free to go and speak to the administration and bring up ideas that they have.

All teacher interviewees concurred that there is a great deal of teacher collaboration and that the morale of the staff is high. For example, a teacher in her first year at School Two:

> Morale here is very high. The school itself is a wonderful school. I find, especially, as a new teacher, everyone tries to make you feel accepted and they know that you're a new teacher. If they have new ideas or instructional materials, they share them with you.

The collaborative culture at School Two extends to the school-community relationship, as well. The educators recognize the place of their school in the community. Teachers provide courses in the use of ICT to parents and other community members. Also, the school is the centre for the local television cable station. As a result of its central place in the life of the community, the school appears to enjoy considerable community support. The principal expressed strong feelings about the place of the school in the community:

> The school is basically a community centre. Taking a school like this out of the area would be total devastation! Our school is open seven days a week. Our students are here in school, doing something, seven days a week. And that's all with the help of some of the parents that are involved. . . . Also, we're teaching a group of parents, an introductory, novice computer course. Our technology teacher is doing that Monday evenings.

Similar to School Two, School Three serves as the hub of seven communities in the local region. While leadership does not appear to be quite as collaborative as in School Two, the teachers are quite enthusiastic in respect to the level of teacher cooperation at the school. For example, one teacher commented, "I think the entire staff work together tremendously, and you can always find a lot of teachers to pull together and help you out no matter what you're doing." It is apparent that the principal

is supportive of distributed leadership. He has allowed the technology resource teacher to exercise leadership in her field of expertise and he appears to be supportive of her efforts, as well as the efforts of a team of teachers that she has organized to lead technological change in the school. Students demonstrate leadership through the school's peer tutoring program, whereby, many of the high school students act as tutors to students in junior high and elementary grades. As well, teachers have begun to accept a student leadership in respect to learning as it relates to technology as is revealed through the following student comment:

> Mary was sitting down at a computer, and Mr. Paul was there and he was looking to get into a certain thing or he was wondering what was going on, he leaned over and he asked her for help. So, when it comes to computers, they don't always see themselves as experts.

At School Seven, there are few formal committees; however, the environment is a collaborative one. In fact, it appears that the culture of this school is a fully functioning collaborative culture. As a result, formal, bureaucratic structures and procedures are not required as a means of ensuring collaboration. A teacher described the collaborative culture as follows:

> There aren't many committees in this school. When decisions are made, it's usually done between either a teacher and the administration or a teacher and a department head or something along that nature. If I have initiative and creativity to start a project, as long as I can demonstrate that kids are going to be working on objectives and there were objectives in the course, then I have a lot of freedom to do pretty much what I'd like.

The principal stressed that "almost every teacher in this school is a lead teacher in some aspect of school life." She felt that her role as a leader was to create a supportive atmosphere for teachers. She contended that she strives to treat teachers with respect and she trusts them as professionals. As a consequence, she argued,

> The teachers have a sense of freedom in our school, knowing that such freedom comes inside certain boundaries of what's expected in a school. Here, they have a tremendous amount of freedom to take risks. And of course you have seen that reflected in our technology program.

While school restructuring has resulted in major changes to the teacher and student population of this school, the collaborative culture has been maintained and teacher morale in this school has remained high. This collaborative culture has been extended to the community, as well. One teacher commented that because the school has done a superb job of involving its community, restructuring that resulted in school consolidation in the region did not result in major protests that had occurred in many other regions.

In respect to ICT, the principal commented that she did not have the interest or the skills to provide direct leadership; therefore, she was quite pleased that she was able to provide an atmosphere in which others felt encouraged to lead. She admitted that she had not been always comfortable with sharing leadership, but she had come to realize that leadership is knowing when to defer to teachers' expertise and enthusiasm. She asserted:

> With my background, technology in this school would be nowhere without someone with a vision and someone with energy to bring it where it is because I don't have that knowledge. It's not an

> interest of mine to know it. It's an interest of mine in terms of promoting it. So, unless you have a principal who's very technologically involved and has his or her own vision to lead the way, you really need a person on staff who can fill that role.

School Eight, like School Seven, has no formal committee structure to provide leadership; however, there exists a culture of collaboration that facilitates the routine formation of informal ad hoc committees that work on specific projects. According to one teacher,

> Most collaboration is informal, but keeping it informal you're allowing everybody to get involved. Rather than just having a committee assigned to look at a particular topic and making a decision, sometimes it is a particular thing that the school or the staff or the administration feels that we need more research on, then probably we would select a committee to do extra research on that and bring it back to the group. But, decisions, as such, are made by a very informal discussion and it's not kept to meetings. A lot of times, it may be a discussion we're having in the staffroom lunch time or on a break, and something will come out of that discussion and then one of us will make note that, that's something we need to have a more formal discussion about.

The collaboration at this school seems to be based on a culture of shared leadership. It appears that the ideas and visions are the prerogatives of all personnel and there exists an openness to innovation. A teacher commented:

> Sometimes the administration will come to the staff and suggest things we may want to try for change. The staff is very receptive to that. And even though we may have criticisms of some idea, we will try it. If it doesn't work, then we'll say that we don't think that worked well. "Maybe, we should go back or whatever." And the same way, if we see things that we want to change, or things that we think we can improve, if we go to the administration, they will try those for us as well.

The following comment by the school principal provides a clear image of the relaxed, collaborative, innovative culture that exists at School Eight:

> We are a rather informal bunch, I think. It's not a matter of formality. The work you see coming out of this school is not the result of some committee who took a task and went away with it. More often, our best work comes from a group of teachers out in the staffroom who are relaxing at the end of the day, tossing around ideas. That, to be honest with you, is where our best work comes from as opposed to formal committee type operations. We don't operate that way. All I can tell you is that we have a staff who are not afraid of change, who embrace change, who have the attitude, "yeah, the hell with it, we'll try it. If it doesn't work, we'll go back to what we had." I am naive enough to let these fools go ahead and try stuff, without really knowing what they are doing. They know what they're doing, but I don't. Sometimes, you got to take a chance. You have to trust the people who you are working with and they have taken the chances. I encourage them to take the chances and they haven't let me down. But again, I got a staff in this building that is second to none in the country and individually and collectively, they look out to each other.

It is this collaborative culture of innovation that has allowed them to progress in the implementation of ICT. As a rural school that serves a sparsely populated region with a sluggish economy, funding for ICT infrastructures is not readily available. There exists little pressure from the school board for

teachers to employ ICT in their teaching because they are not able to provide the necessary resources to support it. In spite of this, the school principal and several teachers sought to learn from the experiences of another urban, high profile school that was known for its success. As a result, through a major business partnership and various federal government programs, they have been able to establish the ICT infrastructures that they envisioned. Within two years, the school has progressed from being a traditional rural school with little computer technology, to being identified as an innovative school. Students and teachers now use ICT extensively for a number of courses.

At School 10, leadership is more formalized than at School Eight. The school is located in an urban centre and draws students primarily from a suburban, upper-middle class neighbourhood. The principal noted that decision-making is a consultative process, but that she and her vice-principal have specific agendas that they promote. All teachers that were interviewed appreciated the principal's openness to new ideas and the extent to which she supported innovative teaching methodologies. It is apparent that the principal is quite supportive of ICT. While she is not directly engaged in leading innovation in this regard, she is very supportive of the teacher-librarian who has taken a significant leadership role.

Teachers noted that most decisions are made collaboratively and that there is a good committee structure in place. Interview data suggest that many teachers are actively engaged in the integration of technology into school programs. Currently, four teachers serve on a technology committee that is responsible for decision-making in respect to technology at the school. Also, teachers are extensively involved in computer clubs that are offered to students four days a week. In spite of this involvement, both the teacher-librarian and the principal express concerns that in respect to ICT implementation, collaboration among teachers and grade levels is not at a preferred level. They recognized, however, that things are improving in that regard. The teacher-librarian commented:

> Last year, I felt overwhelmed. . . ., but since this past fall, things started to change. Some of the teachers came to realize that they were behind the times and they needed to make changes. They realized that they had responsibilities, or their students were going to miss out.

Similarly, the principal observed that "technology is becoming more and more a part of the program for more and more teachers. I think that's really positive."

Leadership at School Fifteen appears to be collaborative, and teachers, parents, and students appear to play an active role in that collaboration. For example, junior high students tutor the younger children during lunch break. Parents are active as volunteers throughout the school and are directly involved in their children's learning experiences. The teachers work collaboratively at their grade levels and are members of the school improvement committees. The teacher-librarian affirmed that he feels that he is well supported by the administration and that he feels empowered to provide leadership in his area. He explained his impressions of the school administration as follows:

> The administrators are excellent in terms of ICT. It was their decision last year to hire somebody who had a strength in technology. They took me in the very first day and they said the lab is mine and to make my mark. That's what they told me. At the very first staff meeting, I made a proposal

> to change the school into a STELLAR[3] school and to buy a new server. I put in a budget for over $12,000. I spoke with the administrators and they wanted staff to have ownership of it. So, we took it to the staff, I made a presentation at a staff meeting, and they all thought it was a great idea.

The teachers that were interviewed were quite happy working at this school. They perceived that morale was generally quite high and they were quite positive about the decision-making process. All felt that their ideas were valued and that they were given the freedom to explore any creative ideas that they had. The school has operated for a number of years with a grade level committee structure that facilitates grade level collaboration. In fact, the teachers felt compelled to note the amount of time and energy that they devoted to committee work and collaboration. For example, one teacher stated:

> It's a very, very good school to work in. The morale at the school is very good. The teachers have a very good morale and everybody loves to work hard and we're always "meetinged" to death because we're always getting together to do something for the students or for the school, trying to make things a lot better. So, we're always meeting. Every grade level meets once a week to coordinate how they're going to keep on track with each other. There are three classes in each grade level.

Two years ago they began a formal process of school improvement. They chose to work on two focus areas: the integration of technology into the curriculum and school spirit. Four subcommittees were formed to deal with the technology focus. The principal explained that teachers, rather than the administrators made the final decisions regarding the school's direction and the formation of particular committees. Each teacher is a member of at least one of those committees.

Since the beginning of these technology committees, the school has progressed rapidly in ICT implementation. The teacher-librarian explained that he works with all classes and the classroom teachers on a regular basis to work on projects and research units. In addition to regularly scheduled classes, students have access to the computer lab before classes in the morning, during recess, lunch time, and after school. While the teachers take ownership of much of the progress, they recognize the significance of the leadership provided by the teacher-librarian. One primary teacher commented: "Mr. B is our guide, our total guide. If we didn't have him, we would be lost. We do the teaching and research in books and things like that and then he is our total guide with the computer."

As one assesses leadership in these schools, it becomes readily apparent that both the formal structures and leadership vary. Some schools have established elaborate school improvement structures while others have no formal identifiable improvement process at all. Similarly, there is no clear pattern of principal engagement. In some schools the principal is directly involved while in others the principal gives support for the ICT initiatives without any direct engagement in the process. The common elements that facilitate organizational learning are as follows: Leadership is perceived to be strong, collaborative, and shared across various constituent groups; morale is generally high and there is a

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[3] Schools that are designated as STELLAR school are supplied free 4 Mbps cable connectivity to schools through a partnership agreement with STEM~net and a local cable company.

general sense of excitement that innovation is supported within the school and that it is safe to take risks. Except for two schools, School Eight and School Ten, the prominent place of the school in the community is viewed as an asset, and community support is perceived to be a significant facilitating factor. As well, the focus of the learning is on building the school's capacity in order to maximize the use of ICT in teaching and learning. While leadership is shared, it is easy to identify one person who has championed the ICT focus. The formal role of that champion varied from school to school; however, the primary champion in each school was either the school principal, the technology-resource teacher, or the teacher-librarian.

Moderately Innovative Schools

In the moderately successful schools, a few pioneer teachers are involved in the use of ICT to expand learning opportunities for their students. These teachers have integrated some of their projects across the curriculum, but are highly dependent upon one or two individuals to provide leadership and support. Generally, they are struggling with implementation issues in order to increase use throughout the school. Leadership in these schools is somewhat similar to that which exists in the innovative schools with several differences that may partially explain the difference in the degree of success that they have had in implementing ICT across the curriculum. While morale appears generally high, there were several dissenting voices. Decision-making remains the prerogative of the administrators even though committees exist. These schools lack the more pervasive team leadership that is evident in the "innovative" schools. The teachers appear to be waiting for direction from their principals. As a result, creativity and innovation are somewhat stifled. In spite of this, teachers and administrators are generally content with the level of ICT leadership within the school. Some believe that their level of integration of ICT into teaching and learning compares favourably with neighbouring schools without having substantiated any of their perceptions. Others believe that they have not progressed as well as other schools, but blame their lack of progress on external sources such as the district or the provincial government. Organizational learning in these schools is inhibited by an inflated sense of success, a model of leadership that limits creativity, and a resulting pervasive sense of complacency.

At School One, leadership is distributed through various school improvement committees with each teacher belonging to at least one committee. These committees are focussed on student achievement in various subject areas and on developing goals for their specific area of responsibility. While the principal contended that he used the school improvement process as much as possible, one teacher suggested that this does not insure collaborative decision-making. He stated that, "sometimes the administration appears to be sort of 'closed-door' towards things. The principal doesn't want to hear, or if he hears, he doesn't act on it." Further, this teacher suggested that ideas were filtered through the principal before they were brought to the staff for a decision. This same teacher suggested, as well, that,

> Morale at times is low, but I think it's a factor of the teaching climate in general in terms of dealing with Government and being turned down for salary increases and so on. We do have morale problems, but we seem to get by with them anyway.

Contrary to this one teacher's opinion, however, a second teacher felt that morale was high. She stated, "This is a really comfortable place to teach. We have wonderful students. It's a good staff, a very settled staff." These conflicting perspectives appear to be indicative of differences throughout the staff.

As for ICT implementation, School One is a recognized Community Access Point (CAP) for the Internet through a DirectPC satellite dish. The principal recognized that the technology teacher and the past principal had provided the leadership in ICT and that it was through their efforts that the school had become a CAP site. When asked by the interviewer, he was unable to articulate a personal or shared vision of future implementation. He complained that the implementation of ICT was dependent upon the technology teacher, rather than distributed throughout the teaching staff. In order to move beyond this stage of ICT implementation, he proposed an approach consistent with the traditional leadership model, whereby someone at the top of the hierarchy would exert pressure to require teachers to learn and use technology.

The level of student leadership in the implementation of ICT at this school is somewhat innovative. The traditional barriers that exist between teachers and students appear to have disappeared in this school. High school students routinely assist primary and elementary teachers in classes requiring the use of ICT and they act as facilitators and instructors in teacher training sessions related to ICT. The following comment suggests something of the relationship between teachers and students in this regard:

> If students know and I don't, I figure reversal is fair play to ask them for help. It gives them a lift to be able to show the teacher something. If they're experts, then why should I be too up tight or too silly to ask them to show me how to get into this site, or to find such and such? The expertise is there, why shouldn't I use it? I can't be bothering the technology teacher all the time because he's got his own work and his own classes.

This school has progressed in the implementation of ICT. The direct involvement of the past principal, the leadership provided by the technology teacher, the high morale of some teachers, the leadership exhibited by students, and the willingness of teachers to engage in a new collegial relationship with the students provide a climate that is supportive of ICT implementation. However, it appears that this school lacks the more pervasive team leadership that is evident in the "innovative" schools. The teachers appear to be waiting for direction from the principal who obviously does not have the necessary expertise.

At School Five, leadership is somewhat distributed to committees; however, decision-making remains the prerogative of the principal and vice-principal. In the following comment, the school principal clearly reveals that final decision-making at the school level remains his prerogative:

> I have a vice-principal and normally before we reach a decision we'll chat about it. In most cases, I have a number of committees created here whose task is to open discussions. Each committee works independently, and if there's a question of having to make a decision that affects the school, obviously, it's brought to me.

At School Six, a similar approach to decision-making exists, as can be determined by the following teacher's description of his involvement in decision-making in the school:

> Well, I often talk to the principal about different projects that we're doing, or something that we're doing different, or something that I'm thinking about doing in my class. So, if I have a planning period or sometimes recess time, I go by the office and if he's there, then we'll chat about it. We have grade level meetings about once a month and other than that, there are different committees in the school.

A response from another teacher at School Six suggests that there exists a committee of teachers focussed on the promotion of science and technology; however, it remains clear that major decisions are made by the principal:

> We have a Science and Technology Committee that's really focussed on students and what we can do for students to promote Science and Technology in the school. The committee is more student-centred, but there are also decisions that need to be made. However, anything regarding budget decisions in the school would go to administration. If there's something that I need or require, then I go to administration.

Teachers in both School Five and School Six appear to accept this approach to decision-making. All teachers were quite consistent in their description that while they engage in discussions as members of various school committees, the principal makes the final decisions. However, no one raised a concern regarding the decision-making process. Teachers appear to enjoy working at these schools and several noted that students, parents, and the staff feel positive about the educational opportunities provided.

At School Twelve, there exists a committee of lead teachers for various subject areas, but final decisions remain the responsibility of an administrative team of three people, the principal, vice-principal, and the guidance counsellor. The principal described the administrative structure as follows:

> We have what we call here the lead teachers, probably leading into department head status. We do our usual staff meetings, of course. We have lots of committees. We have a technology committee and a science committee. We have lots of staff involvement in terms of decision-making. I would never ever want to make decisions party to one or two people. The administrative team, the principal, vice principal and guidance counsellor, meet regularly, and jointly make decisions on just about everything that happens.

One teacher's response to a question of how decisions are made in the school suggests that while teachers have input, the principal has maintained his "position power" in respect to decision-making. She responded: "There is a group of teachers who get together and discuss these sorts of things and as far as approaching the principal goes, he is very receptive to any suggestions that we make."

Teachers appear to be quite happy working in this school. They appear to be content with their level of involvement in decision-making and with their level of ICT use.

Similarly, the principal appears to be quite comfortable with the school culture and with the current state of ICT implementation in his school. He notes that,

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> This school has always been in the forefront as far as technology is concerned. Having people like Mr. F around, and of course our computer technology teacher, in a town like this and a school board like we have, and so on, we've always been out there in the forefront.

The change literature suggests that people endorse change when they feel a need or critical tension to do so. The teachers and the principals at these schools appear to be comfortable with their circumstances and they believe that their schools are progressive in the use of ICT; therefore, it is unlikely that they will have any sense urgency for change. While all schools have progressed in the use of ICT, the limits of the schools' potential to learn may be restricted by an inflated sense of success, the acceptance of a traditional hierarchy, bureaucratic models of decision-making, and a resulting pervasive sense of complacency. Membership on various committees and teams within these schools is generally restricted to educators from within the school. As well, risk taking is minimized as most decisions are controlled by the formal administrators.

Static Schools

In the static schools, leadership tends to be traditional and hierarchical. While teacher committees exist for the purpose of school improvement, the most common expectation of teachers is that the principal is responsible for bringing about change. Organizational learning in these schools is inhibited by restrictive models of school administration, limited expertise, and no apparent stimulant that will initiate learning related to ICT. The existence of a formalized school improvement process with supporting committee structures has not guaranteed success even when the process has been focussed on the implementation of ICT in the classroom. In each school, one or two teachers with a special interest in ICT have initiated several projects integrating ICT into curriculum units with their own classes, but they have not been able to provide the kind of stimulus required to share their new knowledge with others. There appears to be limited vision of the potential of ICT in the teaching and learning environment and therefore, there is practically no awareness of the need for change. Teachers and principals in these schools tend to blame any perceived backwardness in ICT on lack of infrastructure, support, or leadership from the school district and government.

The principal in School Nine noted that teachers had little time for working on committees because they were already committed to involvement in co-curricular activities. In the meantime, he recognized the need to have someone pushing for change. He blamed the lack of impact of ICT on the chaos that had resulted from school restructuring, and he suggested that the lack of provincial and district vision had severely limited progress in technology in education:

> Really our curriculum has not changed significantly. Our ability to implement some of the technological advantages into the everyday curriculum has not changed. I think that's the most staggering part of our education system right now.... Unless you have somebody who's pushing to make the changes, for the most part, they will not happen. The only difficulty that we find with these committees is that we're trying to run an extensive co-curriculum program. Also, we're trying to set up program planning meetings with parents of special-needs students. There's not enough time in the day to also have an ongoing committee structure. In my opinion, we've lost

> this drive for the integration of computers into our school. With all of this chaos due to restructuring and with the lack of a common vision, I think we're back at the beginning. We have not seen any leadership-- the dinosaurs of education are at the top. When you leave things to happen, when it's optional, the majority of times it doesn't happen. When an expectation is stated and the framework is given, it will be done. We would like now to start having computer expectations at every grade level.

While there are some morale problems at this school and an apparent tendency to "blame the enemy out there", some teachers are quite happy to be members of the teaching staff. They feel that they are making progress in the use of ICT at the school and that they have opportunity for input into decisions. For example, one teacher commented:

> They have committees for a lot of different aspects. They have the School Growth Committee and School Improvement Committee and various committees, but when I come up with an idea that I like, then I present it to the principal and he's very supportive. So far, everything that I've wanted to do I've been able to do. So, he's very supportive in that way.

In respect to this latter comment, it is interesting to note that in reference to committees in the school, the teacher employed the third person pronoun "they", giving the impression that she does not feel ownership of these committees. Further, when she has an idea, she shares it with the principal, rather than the committee. The process that she described is entirely dependent on the goodwill of the principal and appears to be hierarchical, rather than collaborative.

At School Thirteen, there exists an elaborate committee structure. There is a school improvement steering committee whose membership is made up of teachers and school administrators. In addition to this steering committee there are various subcommittees of teachers, students, and parents that provide leadership. However, in spite of the committee structure, the principal and vice-principal are the primary decision-makers in the school. The principal explained that there are three levels of decision-making in the school. The first level includes teachers as members of a school improvement committee. This committee meets at the beginning of each year to determine the annual goals. On the basis of these goals, new committees made up of teachers, parents and students are formed. The second level of decision-making rests with department heads who make decisions for their academic unit. Finally, the administrative team of principal and vice-principal meet on a weekly basis to review what's happening. They talk about their priorities for the school and collaborate in making the decisions.

It is evident that decision-making is made within the context of a hierarchy. The final decisions are made by the school administrators. A teacher who is a member of various school committees described the decision-making process as follows:

> As far as decisions being made, there are some that we do have a great deal of representation in decisions that are being made and others that we don't. Sometimes we have made decisions that have gotten changed.

Leadership at School Fourteen is management focussed. The principal is in his first year in that role at the school. The school is a large urban school that has enjoyed a strong reputation as an academically superior school. Each year, students of School Fourteen receive disproportionately more provincial scholarships than other schools in the region. The previous two principals have been traditional administrators, focussing mainly on management concerns. Several attempts to engage teachers in a collaborative school improvement process have failed. While the current principal has initiated a school improvement process in the school, as mandated in the Provincial Schools' Act, it appears that he has accepted the culture of the school which is focussed on maintaining traditional practices. Because of the level of success in academics and general community acceptance, the teachers at School Fourteen have a high level of efficacy and their morale is generally high. A new teacher observed that,

> there is a really good feeling here. The school morale is fairly good. Teachers work together fairly well. I think there is pride in the school on the part of teachers and students, and teachers have input into decision-making in this school.

Unfortunately, there exists little awareness of a need for change. Even though our interviews and observations revealed a distressing lack of innovation in respect to ICT, the lack of awareness of the school's backwardness by even the technology teacher was mind-boggling. As a result, the school has not focussed on the implementation of ICT into school programs beyond the minimum expected in provincial curriculum documents. In such an environment, collaboration appears to result in "groupthink" (Janis, 1982). The new principal's approach to leadership appears to be laissez-faire. For example, when asked what his plans were for the next two years his response was as follows:

> Well, I think if I were going to set a two year plan, the first thing that I would do is to meet with my staff council and we would solicit suggestions from different people on our staff and then go to the outside and see what--you know, get help from the school board and then set our directions. It is very difficult for me to say because, number one, that is not how we do things here, and number two, you know I certainly wouldn't have the answers.

He expressed a degree of contentment with the current level of ICT in the school and appeared not to be aware of the school's backwardness in ICT use when compared to other schools. He was quite excited about the fact that he had recently begun to use a school administration software program. He appeared to be unaware that many schools in the province have been using this software for several years. In that regard, his primary goal for the wiring of all classrooms for ICT is to provide teacher access to the records maintained though this software. He stated:

> Just last summer, we had every classroom wired for accessibility, so now, we can hook into basically every classroom with a computer system. Eventually, what we want to do is to have a computer in every classroom so that teachers can access our administrative programs and allow them to keep tabs on student progress.

As is the case in School 14, the principal of School Four is in his first year as principal. While he espouses a belief in team leadership, he does not practice it. The following comment suggests that he has confused collaboration with consultation:

> I have found since September that the staff is trusting me more and I think the relationship is warming up more and more towards me as opposed to earlier administrators. I think there was more of a distance between them. I want to act in an atmosphere, or to create a climate, where they're comfortable with me as one of their peers. All decisions, I try to make, I usually try to run them by the staff. I believe in the collaborative model, but now like everything, there are times when you need to make a decision on the spot. But I do believe in getting staff's opinions first. That doesn't mean I always listen to the staff, but at least, I feel out what's going on and try to make decisions through a consensus approach.

Comments from teachers, though positive, clearly reveal that the principal is the primary decision-maker.

The principal of School Eleven operates within a similar framework. He described an elaborate committee framework; however, these committees serve to advise him on their priorities and he attempts to meet their needs:

> We organized a committee that I call a professional development team of teachers where I took the Assistant Principal, Guidance Counsellor, the Special Education teacher, and all the department head representatives. They're running the administration of the school, including school improvement and budgeting, so that everyone knows exactly what has been spent here. They give me what they need. If it's a need related to technology, or whatever, I try to meet those particular needs.

The following comment from a teacher in this school reveals a common theme in all static schools that teachers accept the traditional hierarchical model of leadership and are willing to defer to the decision-making authority of the principal:

> You get your point across, sometimes, through conversations next to the coffeepot, certainly in staff meetings and things like that. I find that the relationship with the principal and the vice-principal is more of a professional one than I have been used to. I like it because it's given me the feeling that my opinions count. Sometimes, some of your ideas will be accepted and other times they won't.

It is apparent that changes in personnel and provincial restructuring have impacted negatively on the implementation of ICT into the classrooms of School Eleven. The principal kept referring to a technology teacher that led ICT programs several years ago. As a result of this teacher's initiative, the school progressed; however, when he left, there was a vacuum in leadership. Also, while it appears that the principal has taken considerable direct interest in ICT, it is apparent that there has been little pervasive impact on teaching and learning in the school. This school appears to be a good example of the dangers inherent in the over dependence on the leadership of one or two teachers in a school. This school appears to have been an innovative school that began to quickly decline as a result of staff changes. In spite of the decline, teachers are quite positive about teaching there. They perceive themselves as being "a very collaborative group". While such a positive outlook should be cause for celebration, in this case, it is a source of some concern because it raises the question of why teachers are so positive and so willing to defer to the decisions of the principal, or others, when a

decline in their resources and programs is evident to outsiders (the research team) and to the school principal, himself.

The principal appears to have a vision of what he wants the school to become, but he has not been able to provide the leadership to facilitate progress toward that vision.

> School board personnel have never visited this school. I 'm trying to get them in now to troubleshoot, and to get programs working and so forth, but it's really frustrating, really frustrating, because we're promoting the integration of technology. We jumped ahead very quickly into developing projects relevant to the curriculum, rather than doing technology for the sake of technology. We've been doing that far ahead of the other schools in the city because we had students in the labs and involved in technology for the last four or five years.

While the principal provided many examples of projects that the students in his own classes have completed through the Internet, he did not mention examples from other classes. In fact, he suggested that beyond a small number of teacher pioneers, he has some concerns related to the use of ICT.

In all of these schools there exist committees that are structured to bring about school change; however, these committees are not decision-making groups. In all cases, the principal is recognized as the final decision-maker in the school. There was no reference to anyone that championed the integration of ICT in the classroom with the exception of the ICT teacher in School 11 that had initiated innovation in ICT use. When this person left the school, innovation stalled.

Factors Influencing Organizational Learning and the Implementation of ICT

Nine School principals identified government mandated school restructuring as the most common "change" that has occurred in schools over the last several years. See Table 1. These restructuring changes were not of a programming nature; rather, they related to structural issues such as staff changes, grade level changes, or school closures. The following comment is representative of the principals' perspectives:

> Our curriculum has not changed significantly. Our ability to implement some of the technological advantages into the everyday curriculum has not changed. I think that's the most staggering part of our education system right now, but I think that the way in which this local area is being structured has really shaken the comfort level of a lot of people. So, the biggest thing that we're trying to develop now is to identify who we are.

As well, nine principals identified technology as one of the significant changes impacting their schools. They felt that these changes were dictated by societal demands and the rapid pace of technological change. The innovative and moderately innovative schools recognized those external demands as learning sources and focussed on the implementation of ICT to enhance teaching and learning. With the exception of School 14, those schools identified as static did not recognize external learning sources unless they were external mandates. Even though School 14 did recognize the external advances in technology, that awareness appeared to be rather limited. For example, the

principal was quite excited that all the classrooms in the school were wired for computer network access. He noted that when they were able to place computers in each classroom, teachers would have access to the school administration system:

> Technology is certainly something that's moving ahead at [School 14] as in other areas. One big move that we made this year was the Winschool program. We are very fortunate that we had a good team to work on that. We have a number of teachers who contributed greatly to it.

In contrast to this, a principal of a designated innovative school was quite excited that students were regularly using technology in their daily activities:

> If you walk into our classrooms on any given day, students are giving presentations. They're using overhead projectors, they're using the VCR, they're using videos that they took and edited themselves, and they're using pictures that they took with the digital camera.

Even though the initial source of recognition for the need for change was primarily external, the primary source of learning was school-based professional development and training. See Table 2. This model of organizational learning appears to exist independently of school type, school setting, or level of success in the ICT innovation. The learning that occurred in this manner was largely in the form of knowledge sharing and knowledge utilization by several teachers who had acquired their knowledge from some external source.

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The school-based professional development is dependent upon teachers with particular expertise from within each school (often the technology teacher or the teacher-librarian) who plan and deliver the professional development experiences. These teachers, not only provide the expertise at formal professional development sessions, but also, provide the follow-up support as individual teachers begin to use the technology. The professional development experiences that these teachers have provided, are varied. The experiences include short courses offered during weekends, and various vacation periods throughout the school year; technical and software training courses; scheduled help-sessions during lunch breaks and after school; on-demand training sessions; demonstration sessions; peer-coaching; in-class support; and day-long workshop sessions. Many of the services are provided outside of the regular workday and are provided without remuneration. A principal of a small rural all-grade school recognized the contribution made by the school's technology teacher to professional development in his school and district:

> We've used our own expertise that we have here onsite to in-service our own teachers. Actually, our technology teacher has in-serviced other teachers throughout the district on technology. Just last fall, she did several in-services at a district conference to a couple hundred teachers who were involved in applying for GrassRoots[4] Projects.

Another rural school principal expressed a similar sentiment:

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[4] GrassRoots is a national program that provides financial assistance to K-12 schools for the creation of innovative and interactive learning projects on the Internet linked to curriculum outcomes.

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> Our technology teacher has done a lot of work in inservicing and professional development. She has done a lot of professional development in many, many different areas.

A teacher in another rural all-grade school commented on the effectiveness of school-based professional development and the importance of follow-up accompanied by appropriate support:

> We had a professional development day here last year where Mr. D (the technology teacher) took all the teachers into the computer room and showed them how to get into and use the Internet, how to download, how to save things in your file, how to surf the Internet-- really basic things. This was a really good course as he delivered it. It was good for me this year when I went in the computer room with Mr. D during the first three or four weeks of this year and he taught my students all those things all over again and it refreshed my memory.

Some expressed concern that adequate time was not provided to support knowledge utilization. A comment by a technology teacher who has been extensively involved in providing school-based inservice highlighted the need for an integrated approach to knowledge sharing and knowledge utilization:

> We had a very successful day, everything went perfect, but it just didn't carry over. Like many inservices that I've seen, the stuff doesn't carry over. You go and do it for one day and then you sort of put it on the back burner. We brought them the water, but they still didn't drink.

Another issue of particular concern relates to the need to broaden the level of expertise at the school level. The principal of School Eleven, where progress in the implementation of ICT had been halted as a result of changing school personnel, lamented that the success of implementation in his school was too dependent upon one technology teacher. When that particular technology teacher left the school, new ICT initiatives ceased. While the new technology teacher was willing to assist teachers, he did not provide the professional development leadership of his predecessor.

Some school districts were directly involved in identifying and providing the external sources that allowed the school leaders to acquire the required knowledge. Other school districts were perceived to provide no support at all. The following contrasting comments of two school principals reveal these differences. One principal of a small rural school stated,

> What in-servicing we've had in the past has been school generated. I've got a number of close-out days that I can have in the run of a year for in-service and basically it's tied into our school improvement process and the priorities that we establish for the year. We haven't had any in-service training initiated by the Board. We requested it on a number of occasions, but it never ever got approved.

A principal from another school district whose school is located in an urban centre describes a similar emphasis on school-based professional development, but describes a contrasting level of school district involvement:

> We generally have two professional development days each year which is school-based. At least one of them will involve technology. Teachers are interested and, often we gage the interest and we build our days around the interest of teachers. So, technology shows up all the time, at least once a year. The central office is here, so we're in close proximity to in-service as far as the board

> is concerned, and our board does a good job. The summer institutes offered by our board are big, and several teachers on our staff have done in-service in technology over the summer.

Most suggested that school boards and the provincial department of education should provide both time and expertise to supplement the school-based professional development and implementation efforts. For example, one rural school principal commented:

> On the staff we have a mixture of people. Some people are fairly skilled and others are still at the beginning stages, but we certainly need more time for training and in-service. Now, we've tried at the school level, but we're fairly limited. We really do need more.

An urban school principal who was quite pleased with the level of success that he had experienced also felt quite strongly that the school board and government had to become more involved:

> I think there's a tremendous need for the board and government to get people who have technical expertise into the system and into schools, but more importantly, you got to have someone on staff or someone who can in-service teachers with the use of the Internet and software and whatever the case may be so that it can make teachers comfortable and they can work into it. Now, that's the job of the school boards and the government and those that are in education. Outside of that, there's a tremendous need for what I call educators or people in the technical field that would develop software that is easy and friendly to use.

Many teachers opined that if teachers are to use the technology in their classrooms they have to be comfortable with it. They felt that the shift required of teachers if they were to implement ICT in their classrooms represented major "retooling" which went beyond the level of routine professional development expected of a teacher. They argued that districts and the department of education had to accept responsibility for such "retooling" by providing the tools and the expertise and by accepting responsibility for all associated costs. The implication was that learning had been inhibited because these agencies had not provided the necessary resources. For example, one teacher noted that while she had a personal desire to upgrade her skills in ICT, many teachers did not share her interest or commitment. She felt that if ICT was to be fully integrated across the curriculum then time and resources had to be committed by government. She contended that if implementation of ICT were to remain dependent upon the goodwill of teachers, then it would be a slow, ineffective process:

> Summer is not a good time. Now I don't mind. I would go and do it because I have an interest in it, but not everybody does. It's their time. So, the government is going to have to realize that they have to start supplying in-service days for technology. Professional development is going to have to occur during the regular work time. There aren't too many professions out there where the job you're upgrading comes on your time. If you're professional, then upgrading is part of your job description. And what's being expected of teachers is that they do it on their own time, which is not fair, and you will not get the upgrading, and you will not get the interest if government doesn't come across and do it in the time that it should be done.

A technology teacher highlighted the importance of district support for ICT implementation in his school. He noted that his school district had offered summer courses and provided financial assistance to teachers who attended. He felt that it was unfortunate that such courses have not continued:

> The school board provided summer courses a few summers ago. There was only one summer that these were offered and that focussed on the Internet. I taught these for the school board. We had a portable training network that the school board purchased through federal government funding a few years ago--laptops and cables, and the modems and everything. So, it was our travelling road show. However, things went downhill from there, even though I have provided our staff with in-service on a number of occasions.

A classroom teacher expressed the same concern related to the need to distribute ICT expertise in schools; however, she approached the issue from a different perspective. She observed that "whenever there are training opportunities in technology, regular classroom teachers aren't encouraged to attend." She felt that organizers should provide professional development opportunities with sessions specifically targeted at classroom teachers. She maintained that if teachers were given opportunities to attend such sessions, more teachers would get involved:

> I 'm not saying that technology teachers should not attend training sessions because it would be useless to send me to an institute in technology unless it was really basic. But I think, perhaps, if they did take people with less experience and less knowledge, then they could determine our needs and give us the appropriate help. We could explain how we would like to use ICT in our classes and they could show us. Or, perhaps, we could describe our current abilities so they could explain what we could do within the context of those abilities.

On another issue related to the need for district and the department of education involvement in professional development, several teachers and principals were concerned that no vision or strategic plan for the implementation of ICT in the learning environment had been articulated by their district or the department of education. They felt uneasy that strategic planning was left to teachers and principals who probably did not have the necessary expertise or the information for long-term planning. They feared that they could be spending financial and human resources on misguided ventures. The following comment by a principal is indicative of these concerns:

> I find it very lonely at the school level to try to figure out where you're going in developing plans and so on. It's very much in isolation that you do. We really don't have the support systems to help us through that. So, the worst thing that can happen for me would be to put a lot of money into something and then to realize that we are off track and that perhaps we should be going in another direction. So, it's more trial and error than I'm usually comfortable with.

In respect to the same concern that schools may be misguided in the directions that they have chosen, another principal made a forceful plea for improved teacher education programs based on current research and development in the pedagogical applications of technology:

> We have to be aware that we are just not going to take the technology and do the same old thing that we have been doing for a number of years. That's not utilizing what computer technology can do. We are not ready yet. Universities are not training people. Go to any teacher training institute in this country and you tell me they are producing the kinds of people who are able to deliver the pedagogy I am talking about? Bull! They are doing what I did when I went there, years ago. They have more understanding of technology, but not because they have learned how to deliver, using technology. They have learned to use it and have done a bit of research on it, but I am

> talking about using it as an instrument of instruction, and we're not doing it. We need some very good minds to start rethinking the pedagogy and see where this is going.

Several teachers and principals noted that the division between senior and junior teachers posed a particular leadership challenge. They noted that most of the junior teachers are more proficient in the use of technology as a teaching tool. While many senior teachers have embraced technology, the number of them who employ technology on a routine basis is quite small. For senior school personnel who have learned that experience leads to higher levels of expertise, acceptance that the junior person may now be the expert, represents a significant challenge to accepted mental models. One teacher made the following observation in this regard:

> Most of the schools in Newfoundland are faced with an aging population of baby boomers who are in their late forties or early fifties and very close to retirement. I think a lot of the difficulty in new technology in schools is that you do have a lot of "old horses left in the stalls" and they are not as open to new technologies as the younger teachers. Younger teachers have learned through hands-on that computers and technology can help enhance education. The older teacher may not be aware of the potential of new technologies, or may not be able to adapt.

Several principals noted that it was unlikely that senior teachers would begin to use technology in their teaching unless they felt some pressure or motivation to do so. One principal noted, for example, that senior teachers established their teaching strategies prior to the information technology era. He reasoned that if these teachers are to become regular users of computer technology in their teaching practices, then emphasis must be placed on providing opportunities for them to discover that it can lead to improved practice.

Throughout the interviews the researchers were repeatedly told by teachers in all schools that STEM~Net has been a significant external source of organizational learning. STEM~Net personnel have provided initial awareness sessions, necessary infrastructure, training for lead teachers in schools throughout the province, inservice training for individual schools and districts, summer institutes, and conferences. The following quotations are indicative of the comments heard throughout the province:

> In April, 1998, I did some training with STEM-Net and returned here in September to take up duties. (technology teacher, School Five)

> I initially got involved with this as a pilot teacher with STEM-Net when it came online. That was the seed. Since that time I've been picking up a great deal on my own, but also attending summer institutes and so on. (technology teacher, School Two)

> I guess it all began with STEM~Net. That one computer, and I don't know if it was in the staffroom or it was in our older computer room, but the teachers started with it. (technology teacher, School Eight)

> I can remember a few years back Mr. F was on the go and he brought in a lot of good ideas and informed us and brought us up to date on what STEM-Net was and where it was going. But in

> the last couple of years, I haven't heard a whole lot on STEM-Net to be perfectly honest. So, I'm not sure just how it's branched out now. (technology teacher, School Eleven)
>
> I remember years ago when STEM-Net first came online there weren't many courses here in the school. They designated and trained lead teachers who in-serviced the rest of the teachers on how to use e-mail and so on. (technology teacher, School Thirteen)
>
> Well, we did take advantage of STEM-Net inservice a few years ago. We went into the University in the computing section there and they basically took us through logging on and sending e-mail, and one thing or another. (technology teacher, School 10)

In addition to hearing about the positive role that STEM~Net has played in the implementation of ICT, all of the schools that we visited were quite aware of the national GrassRoots program, and most had operational projects. The existence of this program has acted as a catalyst for innovation. The funding for approved projects provides an incentive for involvement, the successes of pioneer teachers provide models, and the growing awareness of these projects continues to create a "critical tension" required if change is to occur. A new teacher at School Two explained the critical importance of the GrassRoots program for her and other teachers in the school.

> Just last week all primary and elementary teachers met one afternoon and we had an in-service run by Ms. W (the technology teacher). She just explained GrassRoots to us and she showed us three different categories for the money range and things like that. So in this school GrassRoots is something that they've done almost every year since it's been in existence. So, what Mr. B (the principal) wants us to do is for everyone to get involved and to do a Grass Roots project.

In the above case it is clear that the GrassRoots program provided the focus for the inservice and for follow-up implementation. The new classroom teacher, the technology teacher, and the principal reported that information and training were provided in the context of an articulated expectation that teachers would prepare proposals for GrassRoots projects.

It is apparent that various external sources, including the Department of Education, STEM~Net, SchoolNet, and school district offices, provided initial awareness sessions, the essential infrastructures, and some basic professional development and training in support of knowledge acquisition, knowledge sharing, and knowledge utilization in respect to the use of ICT in teaching and learning. The GrassRoots projects have been particularly useful in providing a particular focus that is meaningful to individual classroom teachers. Also, as the numbers of these projects increase and more people become aware of them, it is evident that they provide the "critical tension" required for change.

The school-based professional development approach that is most evident in all schools appears to facilitate individual and organizational learning; however, its effectiveness has been inhibited by several factors: (a) Expertise in individual schools is limited to one or two individuals who have full time teaching positions. These individuals are highly committed, but are frustrated that they do not have the time or supports required to facilitate widespread ICT implementation. (b) Regular teachers, particularly senior teachers, are somewhat intimidated by the new technology and are sceptical of the

benefits to their students or the applicability to the subject areas they teach. (c) Teachers are deeply suspicious that, while the school-based approach may be the most effective professional development model, government has used this model of professional development to save money at the expense of teachers. As a result many teachers refuse to engage in the professional development opportunities that are provided for them by their colleagues, particularly if these opportunities are offered outside of the regular school day. (d) Mandated school restructuring has diverted attention away from teaching and learning to structural concerns. (e) There exists limited time to attend formal training sessions and little support during early use of newly acquired skills.

Discussion and Conclusions

The author began this paper by noting that trying to change teaching and learning practices in schools has proven to be a monumental challenge. It was argued that there is growing evidence suggesting that schools that develop their organizational learning capacity experience more success in the efforts to change. Using organizational learning as defined by DiBella, Nevis, and Gould (1996), the researchers set out to figure out how such learning occurs. Our inquiry, therefore, was to contribute to our understandings related to the factors that facilitate or inhibit organizational learning in schools while giving particular attention to the sources and nature of leadership that influence that learning.

One finding related to mandated school restructuring. While the government mandated restructuring of the school system led to structural changes that principals perceived to be the most significant change that had occurred over the last few years; there was no evidence that these mandated changes facilitated organizational learning. In fact, evidence from several of our case study schools suggests that restructuring inhibited learning in respect to the implementation of ICT across the curriculum. This finding is certainly not a new revelation, but it is insightful, nevertheless. Given the pervasiveness of school restructuring throughout the world, it is dramatic that in spite of the widespread recognition that it represented the most significant change, the perceived impact on most of the case study schools was that it inhibited organizational learning.

A second finding of this study related to the recognition of a need to acquire new knowledge. The recognition of the need for the acquisition of new knowledge in respect to the integration of ICT into teaching and learning appears to have grown from general recognition of advancements in ICT and a perceived expectation from society that schools would have to change if schooling was to remain relevant. Unfortunately, however, these external pressures did not create sufficient tension to facilitate learning in all schools. In fact, while teachers in the static schools recognized advancements in technology, they employed defensive routines that insulated them from the creation of tensions that would initiate the need for learning. Shared knowledge structures stored in the long term memories of the static schools (Senge's mental models) were huge impediments to learning. These knowledge structures created a "groupthink" image of the school that allowed teachers to believe that change was not required. They accepted traditional models of leadership as well as traditional classroom practices. Additionally, senior teachers found it difficult to accept that junior teachers could be a source of new professional knowledge. These "organizational defensive routines" (Argyris,1996) are

unlikely to change without some external intervention that will stimulate reflective practice and double loop learning.

A third insight from this study is that formal school improvement processes, even when focussed on the integration of ICT in the classroom, did not foster leadership to facilitate learning. Similarly, findings from this study suggest that the existence of committees and school improvement teams do not guarantee that a continuity of focus will be maintained over time. This finding appears to contradict conclusions that we have reached in another recent case study focussed on change (Sheppard & Brown, 2000). In that study, my colleague and I concluded that the most important mechanisms for sustaining continuity of change in the two schools that we studied appeared to have been the formal goal setting and the school improvement planning processes adopted by each school. This current study contributes to our understanding of that phenomenon. Where school teams are empowered to provide the necessary leadership, they function as champions of the process. However, if the teams are simply contrived school structures that are subject to the decision-making powers of the principal, they neither serve as effective catalysts of change, nor as effective agents to insure continuity of focus. The difference between the static schools and the other more innovative schools was that in the innovative schools there was someone to champion the cause. In both the innovative and moderately innovative schools, there existed at least one person who had a vision for the integration of ICT across the curriculum and who promoted that vision from within the school. Furthermore, differences between leadership in moderately innovative schools and innovative schools clearly reveal the facilitating impact of a leadership approach that is distributed among multiple sources, is collaborative, solicits community support, and champions the engagement of others in an articulated vision.

A fourth lesson of this case study is that large scale university or government initiatives such as STEM~Net and GrassRoots can have a major impact on the use of ICT in teaching and learning environments in schools. The ICT leaders in schools acquired much of their knowledge from the multiple formal and informal training and educational experiences provided through these external initiatives. The infrastructure and financial supports facilitated knowledge sharing and knowledge utilization within the schools. However, it cannot be assumed that just making such programs available will result in learning in all schools. In the case study schools, the success of such initiatives was largely dependent upon leadership at the local school. While STEM~Net and GrassRoots programs were major direct sources of knowledge for ICT leaders, the primary sources of knowledge at the school level were the internal ICT leaders, themselves, who shared their newly acquired knowledge and assisted others in early utilization in the classroom. In schools where the knowledge was not shared by such internal experts, implementation was limited to their classrooms only, and when these people departed the school, implementation stalled.

Among the inhibitors that we identified were the lack of resources including time and personnel, and low morale. While teachers recognized the strength of school-based professional development as a means of knowledge acquisition and knowledge sharing, a perceived lack of direct engagement by the school districts and the provincial department of education acted as an inhibitor of learning. Teachers were quite suspicious that their lack of involvement in professional development initiatives was a cost-cutting strategy. They suspected that more was required of teachers outside of regular work

hours because the districts and government were not willing to provide the necessary resources required to facilitate professional learning. These suspicions lowered morale which further inhibited learning.

This study provides rich images of leadership within schools and identifies the processes and factors that influence organizational learning. It provides empirical evidence to show that changing school practices, such as using ICT in teaching and learning, is very much dependent upon the level of organizational learning in a particular school. It suggests that societal pressure alone is not an adequate stimulant for double loop learning; nor is the existence of committees and teams a sufficient catalyst for change. It reveals that an external stimulant may be necessary to encourage school staffs to challenge the mental models that help perpetuate a sense of complacency that exists in the long term memory of individual schools. As well, the study provides some further understandings related to the maintenance of continuity of organizational learning. It provides evidence that formal planning processes provide continuity of organizational learning only if there exists a critical mass of leadership to facilitate the process. Finally, it contributes to our understanding of the nature and sources of leadership in the facilitation of organizational learning. It provides additional evidence of the relationship between leadership and organizational learning, and highlights the importance of multiple, distributed sources of collaborative leadership.

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Table 1. Principal's Perceptions of School Change

No.	School Type[1]	Success level[2]	Setting	Most Significant Changes (1)	Source	Most Significant Changes (2)	Source
1	PEJH	M	Rural	Restructuring	Mandate	Technology	External
2	PEJH	I	Rural	Green School	External	School Improvement	Mandate
3	PEJH	I	Rural	Restructuring	Mandate	Technology	External
4	PEJH	S	Rural	Special Needs Policy	Mandate		
5	PEJH	M	Rural	Restructuring	Mandate		
6	PEJ	M	Rural	Restructuring	Mandate	Technology	External
7	JH	I	Rural	Discipline	Internal	Technology	External
8	H	I	Rural	Semesterization	Internal	Technology	External
9	PEJH	S	Urban	Restructuring	Mandate		
10	PE	I	Urban	Restructuring	Mandate	Technology	External
11	J	S	Urban	Restructuring	Mandate		
12	J	M	Urban	Restructuring	Mandate	Technology	External
13	JH	S	Urban	Restructuring	Mandate	School Improvement	Mandate
14	H	S	Urban	Retirements	Social	Technology	External
15	PEJ	I	Urban	Resource-based learning	Mandate	Technology (STELLAR school)	External

[1] P Primary School
E Elementary School
J Junior Highschool
S Senior Highschool

[2] I Innovative School
M Moderately Successful School
S Static School

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Table 2. Professional Development and Implementation Practices

No.	School Type[1]	Setting	Success level[2]	Current Professional Development Practices
1	PEJH	Rural	M	Ad hoc School-based PD, computer technology teacher
2	PEJH	Rural	I	School-based PD Days, computer technology teacher
3	PEJH	Rural	I	School-based PD Days, computer technology teacher
4	PEJH	Rural	S	Ad hoc support and training from computer technology teacher
5	PEJH	Rural	M	Ad hoc School-based PD, computer technology teacher
6	PEJ	Rural	M	STEM~Net and School Board
7	JH	Rural	I	School-based PD Days
8	H	Rural	I	School-based PD Days, outside conferences, STEM~Net, and university research and development project
9	PEJH	Urban	S	Mini-courses sponsored by the school board
10	PE	Urban	I	School-based PD Days, computer technology teacher
11	J	Urban	S	School Professional Development Team, peer coaching, STEM~Net and SchoolNet Internet sites
12	J	Urban	M	School Board and School-based inservice sessions, summer institutes
13	JH	Urban	S	School-based inservice sessions, courses completed by individuals, and preservice education programs, school board sponsored courses available through a post secondary institution, peer coaching, STEM~Net
14	H	Urban	S	School-based inservice on administrative applications
15	PEJ	Urban	I	School-based inservice based on identified needs, peer coaching, STEM~NET training

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